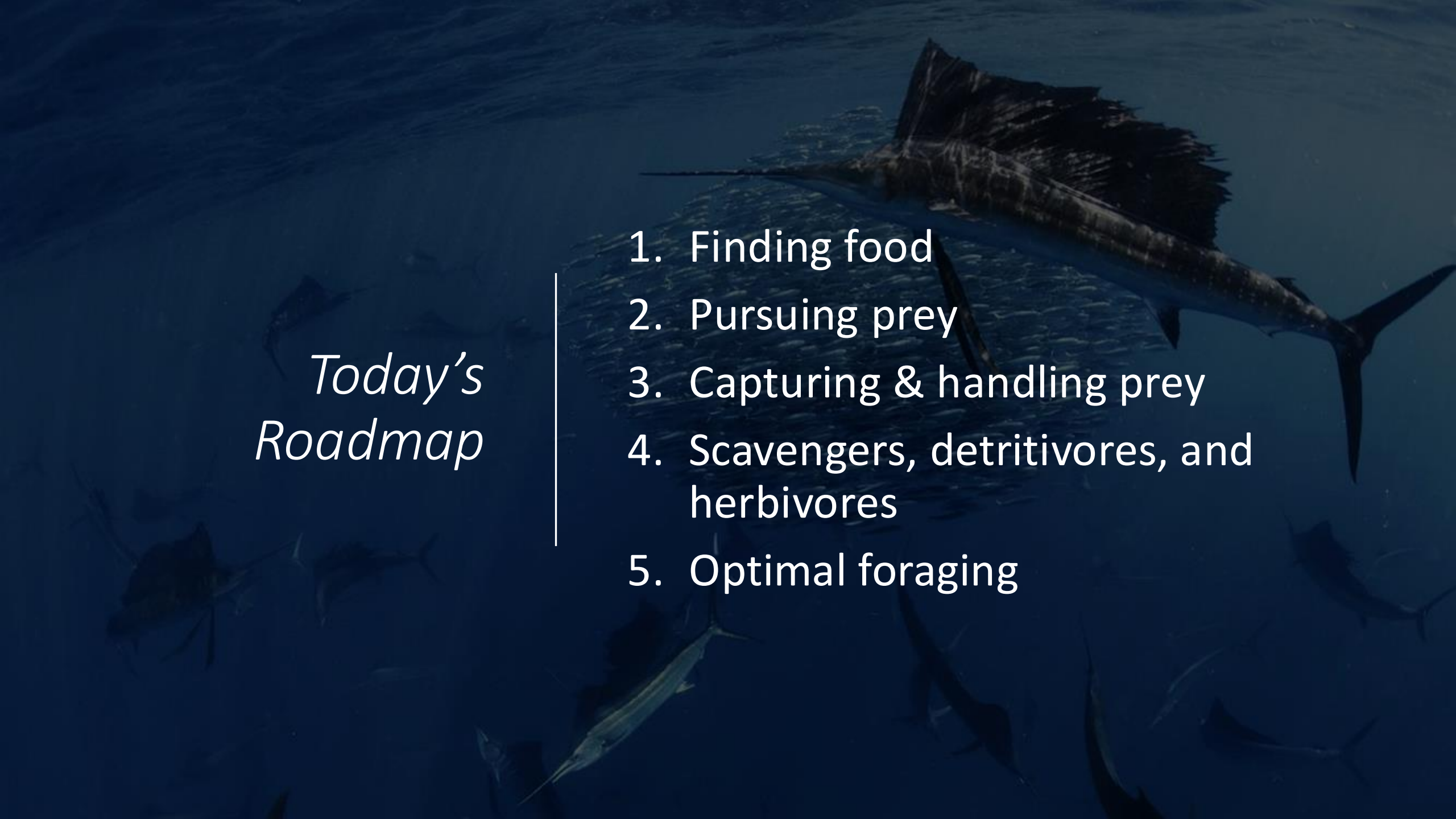
Predators & Prey I:
Fishes as Predators

FISH 310

Photo by Paul Nicklen



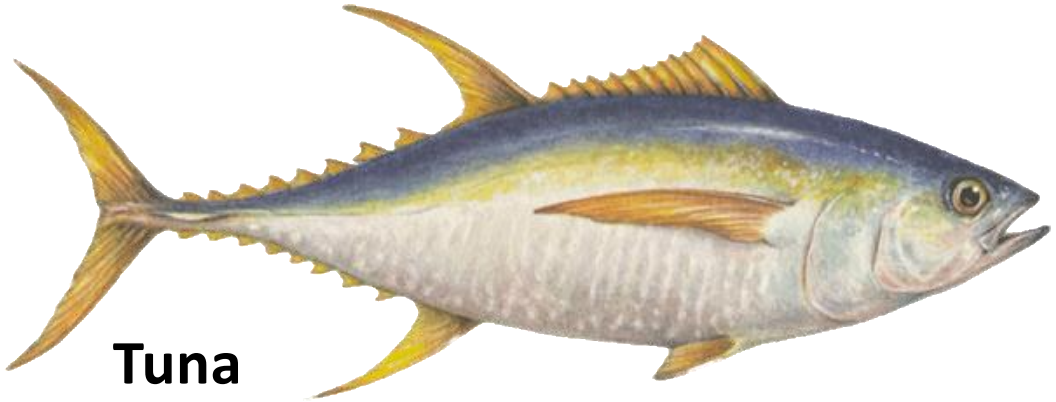
Today's Roadmap

1. Finding food
2. Pursuing prey
3. Capturing & handling prey
4. Scavengers, detritivores, and herbivores
5. Optimal foraging

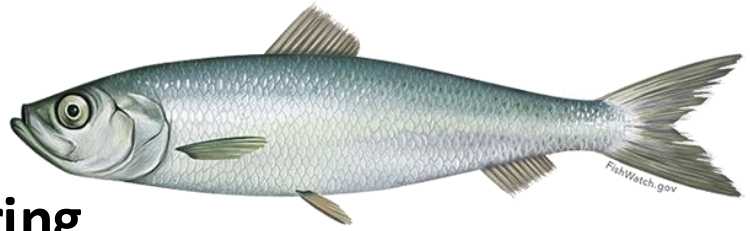
Finding food

- **Active searching** (moving while looking for food) by...
  - **Sight**

Sailfish
Istiophoridae



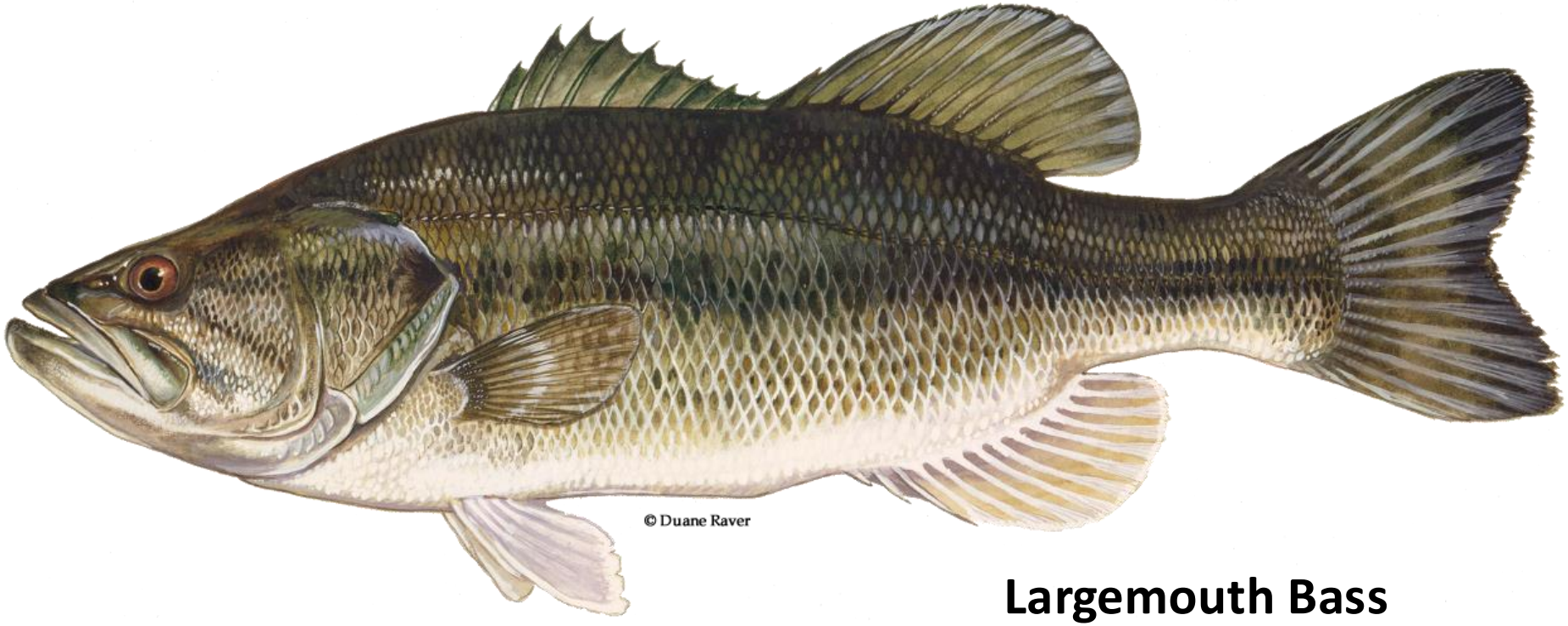
Tuna
Scombridae



Herring
Clupeidae

Finding food

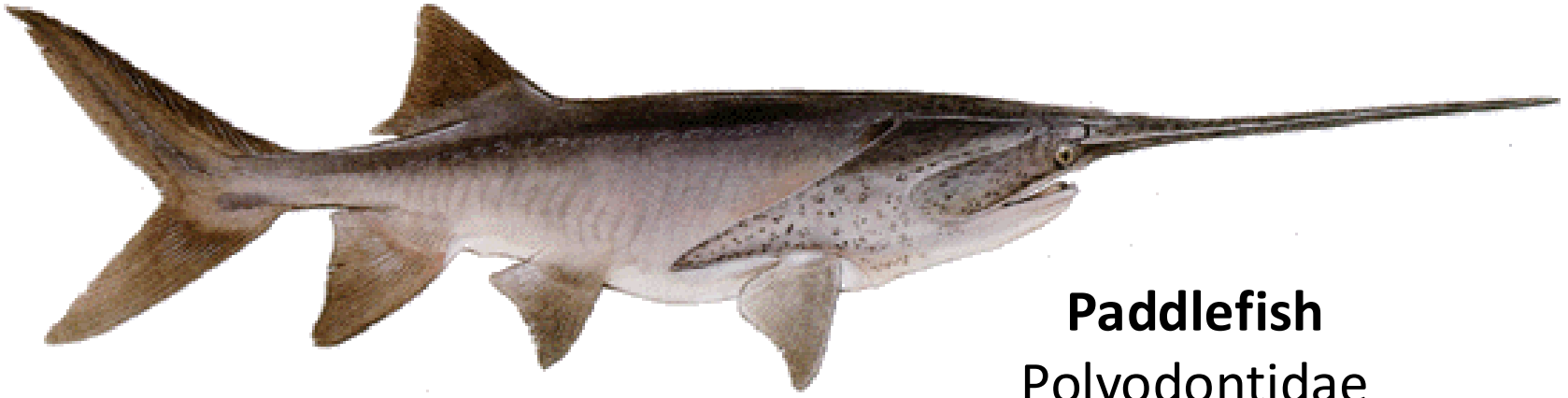
- **Active searching** (moving while looking for food) by...
  - **Sight**
  - **Smell**



Largemouth Bass
Centrarchidae

Finding food

- **Active searching** (moving while looking for food) by...
  - **Sight**
  - **Smell**
  - **Electroreception**

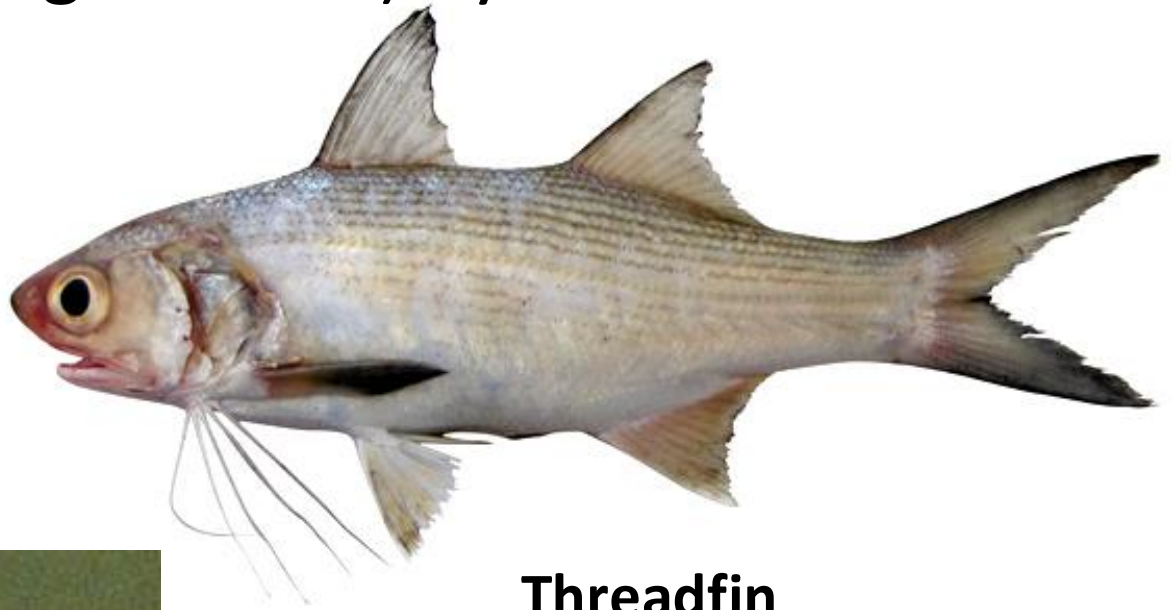


Paddlefish
Polyodontidae

Knifefish
Gymnotidae

Finding food

- **Active searching** (moving while looking for food) by...
  - **Sight**
  - **Smell**
  - **Electroreception**
  - **Gustation**



Threadfin
Polynemidae

Finding food

- **Active searching** (moving while looking for food) by...
  - **Sight**
  - **Smell**
  - **Electroreception**
  - **Gustation**
  - **Touch**

Goatfish
Mullidae

Armored Searobin
Triglidae

Finding food

- **Active searching** (moving while looking for food) by…
  - **Sight**
  - **Smell**
  - **Electroreception**
  - **Gustation**
  - **Touch**
  - **Speculation**

Goatfish
Mullidae

Logperch
Percidae

Logperch feeding!
https://www.youtube.com/watch?v=9n7FTTLXHM0

Finding food

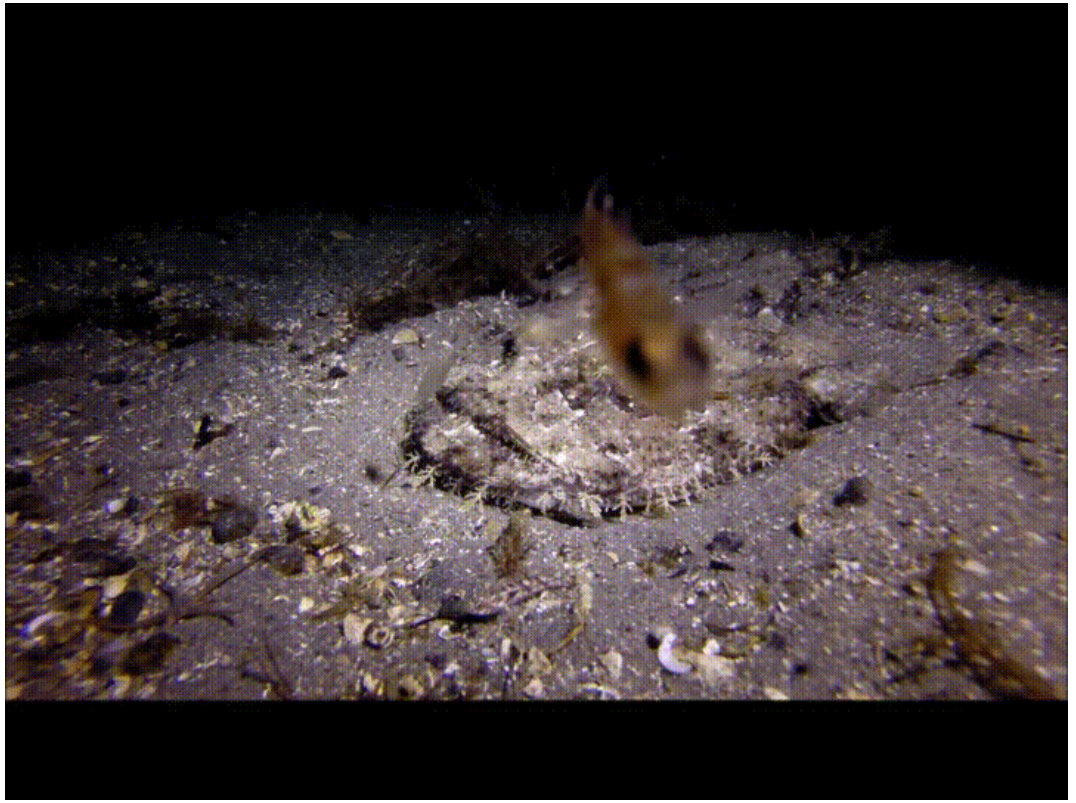
- **Active searching** (moving while looking for food) by...
  - **Sight**
  - **Smell**
  - **Electroreception**
  - **Gustation**
  - **Touch**
  - **Speculation**
  - **Hearing**

White Shark
Lamnidae

Finding food

- Active searching (moving while looking for food)
- **Lie-in-wait predators** (working smarter, not harder!)
  - Benthic

Stargazer
Uranoscopidae

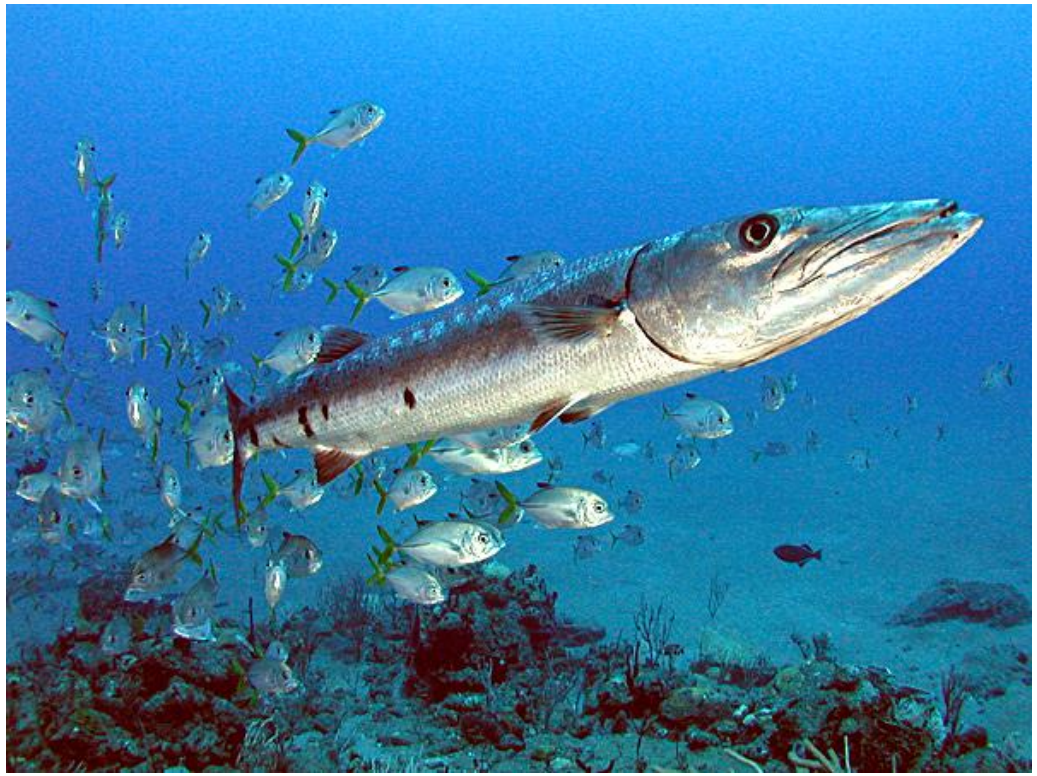


Goosefish
Lophiidae

Finding food

- Active searching (moving while looking for food)
- **Lie-in-wait predators** (working smarter, not harder!)
  - Benthic
  - Pelagic

Gar
(Lepisosteidae)



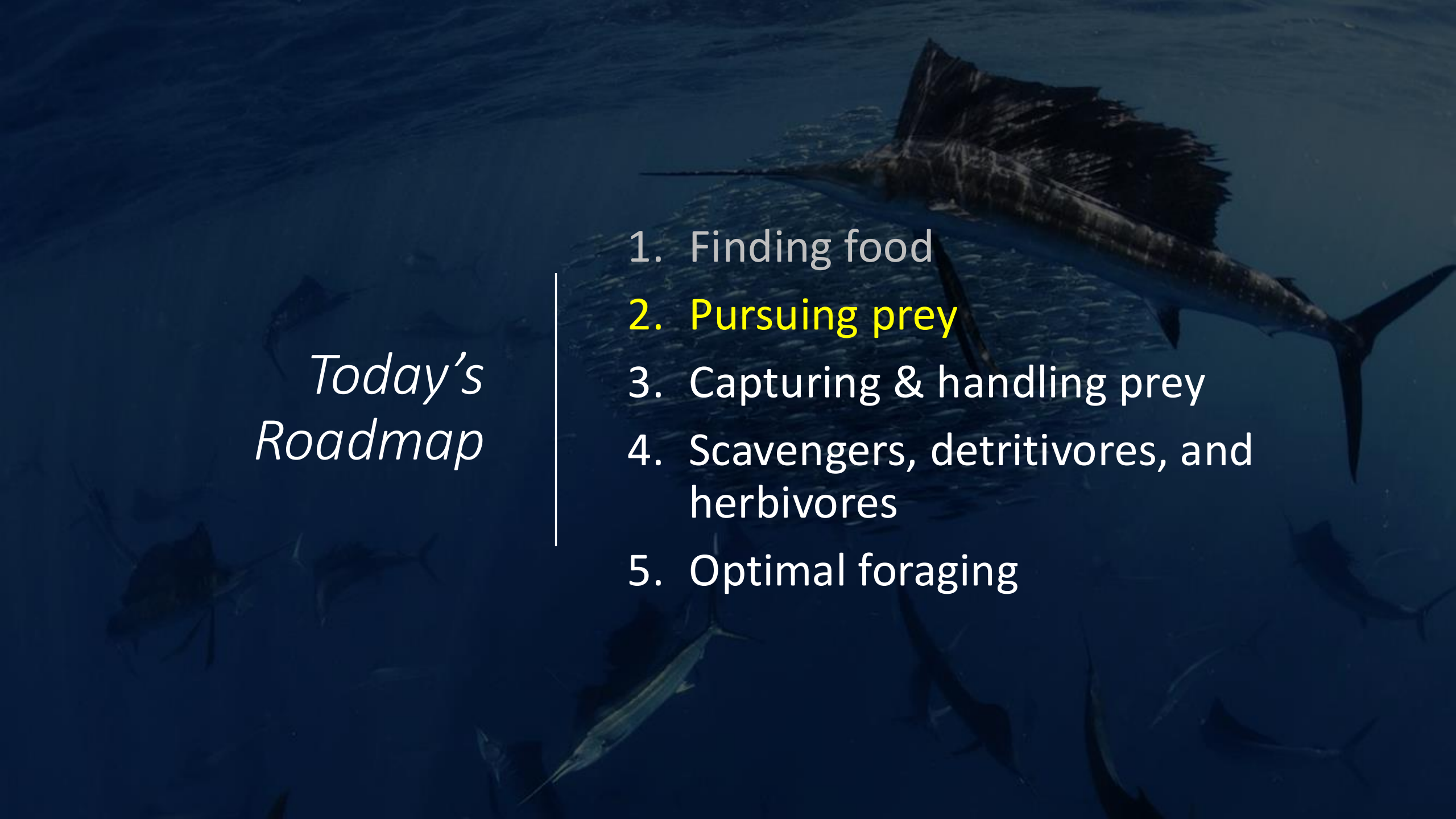
Barracudae
(Sphyraenidae)

Finding food

- Active searching (moving while looking for food)
- **Lie-in-wait predators** (working smarter, not harder!)

Why could it be tough to be a lie-in-wait predator?

So, which feeding mode is more advantageous?



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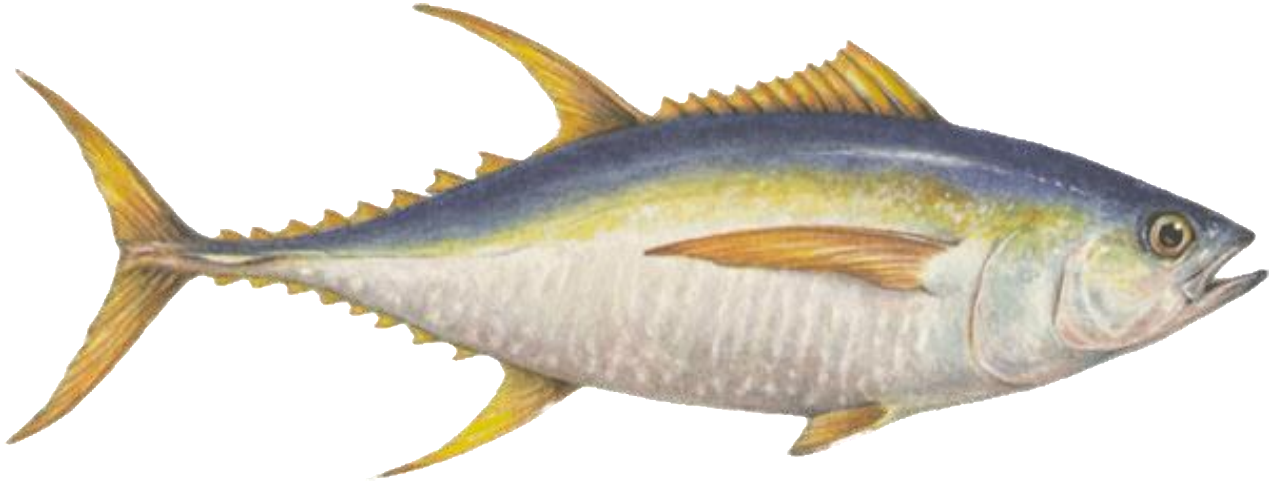
Pursuit of prey

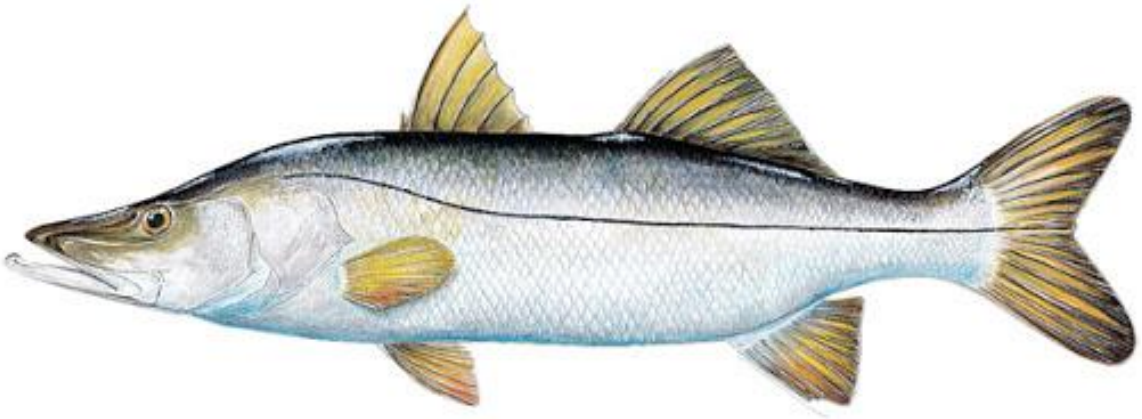
- **Cursorial** predators



Tuna

(Scombridae)

Streamlined fishes, capable of high-speed chases of rapidly-swimming prey



Snook

(Centropomidae)

Pursue prey near shore, streamlining sacrificed in favor of maneuverability

Pursuit of prey

- **Cursorial** predators
- **Lie-in-wait/lurking** predators: fast-start performance

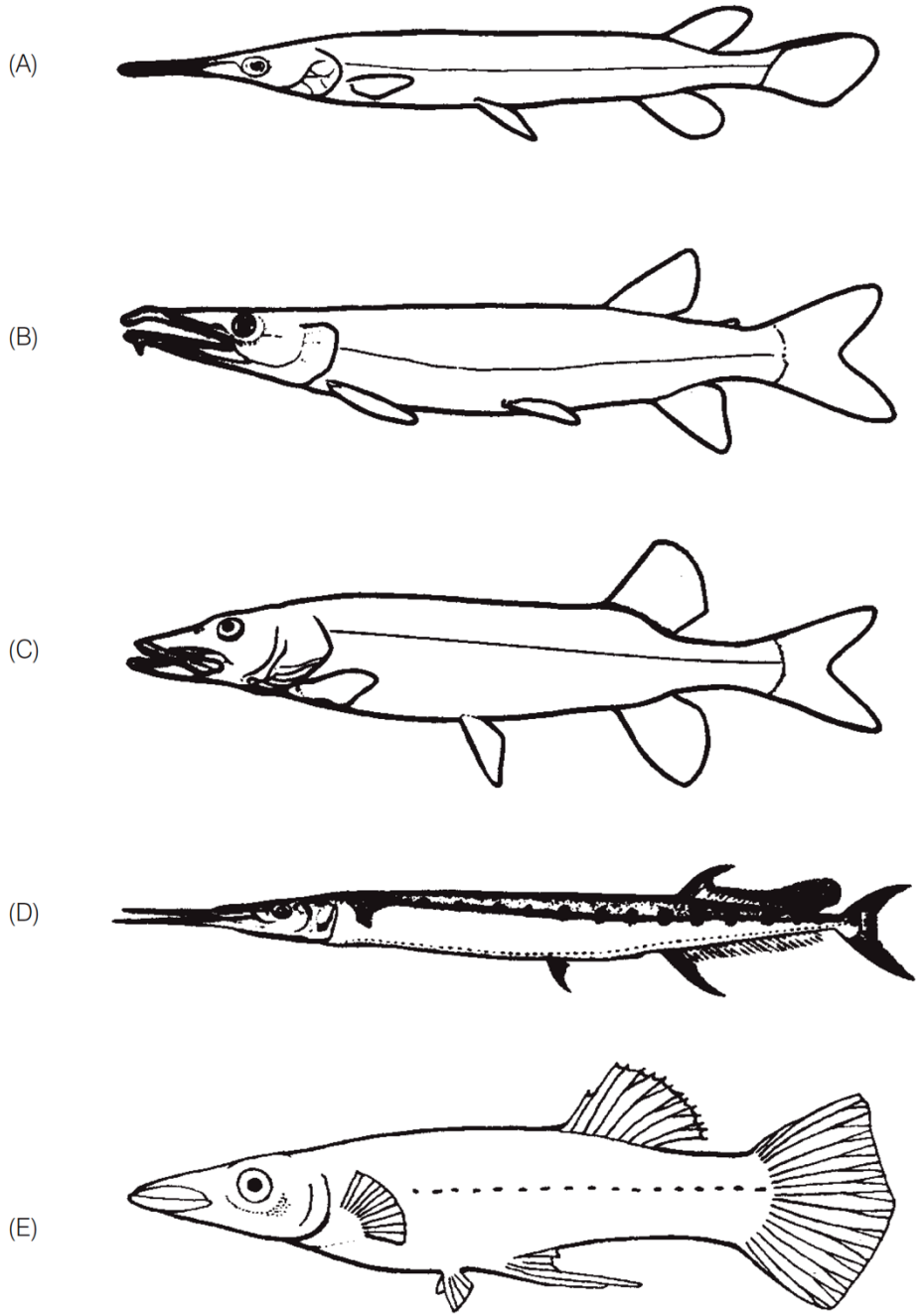
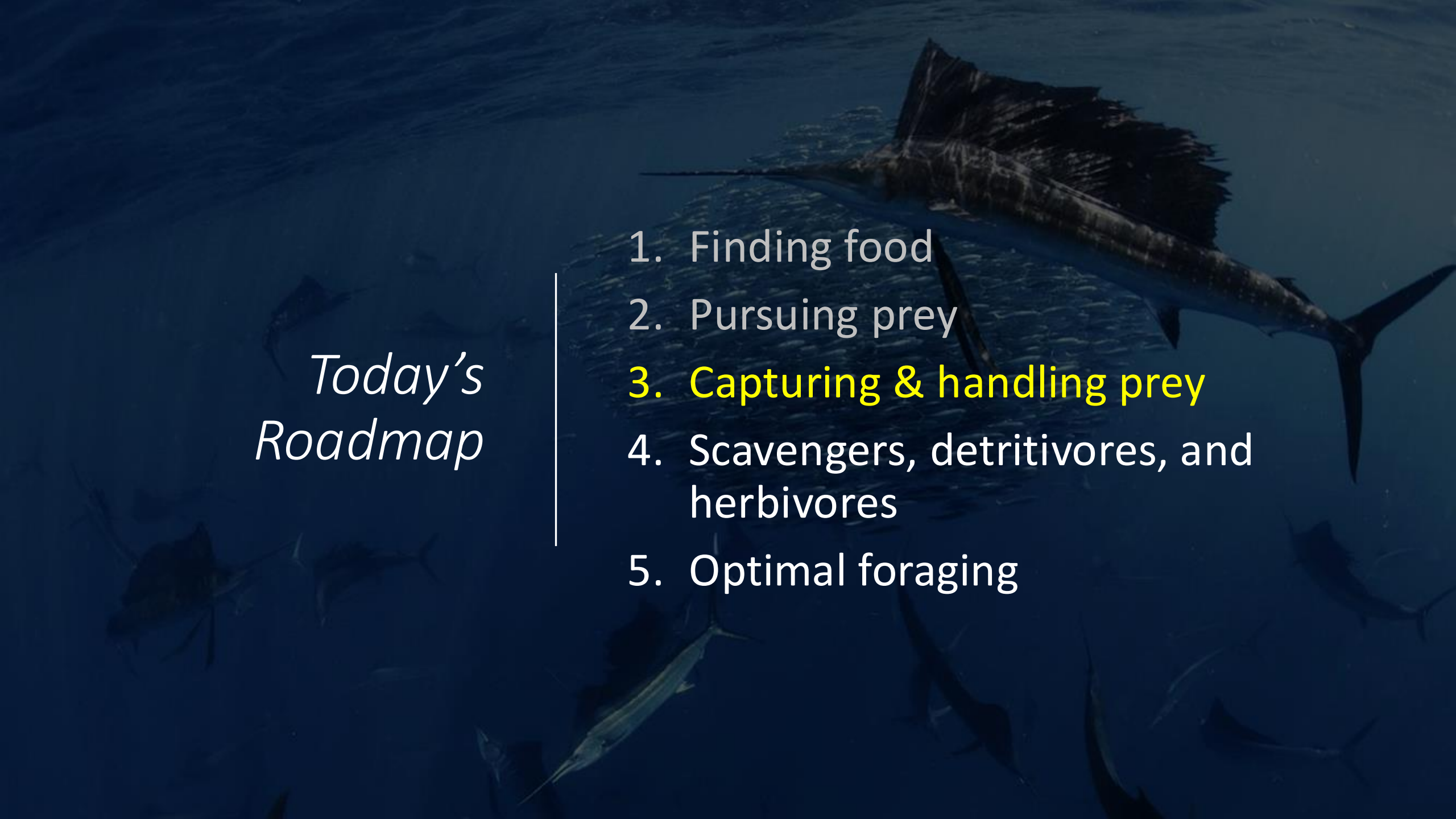


Figure 19.1

Variations on a theme: convergence in morphology among fast start predators. Lurking predators that swim in the water column tend to be elongate with long mouths, sharp teeth, and fins set far back on the body. Examples from six different orders and eight families are shown, including one extinct form. (A) Lepisosteiformes, *Lepisosteus* (Lepisosteidae), gar, 1 m. (B) Characiformes, *Ctenolucius* (Ctenoluciidae), Pike Characid, 1 m. (C) Esociformes, *Esox* (Esocidae), pike, 1 m. (D) Beloniformes, *Ablennes* (Belonidae), needlefish, 1 m. (E) Cyprinodontiformes, *Belonesox* (Poeciliidae), Pike Killifish, 20 cm. (F) Perciformes, *Sphyraena* (Sphyraenidae), barracuda, 1 m. (G) Perciformes, *Luciocephalus* (Osphronemidae), Pikehead, 15 cm. (H) †Osteolepiformes, *Eusthenopteron* (Eusthenopteridae), a Devonian tetrapodomorph, 75 cm. (A–C, G, H) from Nelson (1994); (D) from Collette (1995); (F) from Jordan (1905), used with permission.



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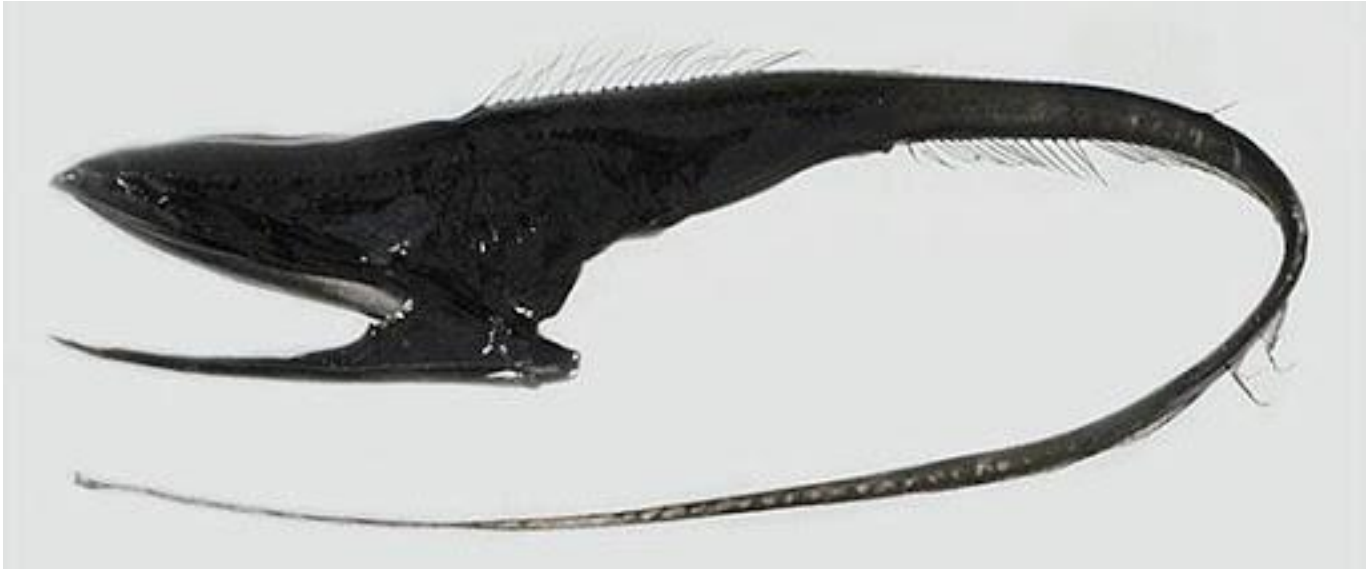
Capturing Prey: **Luring**

- Independent evolution of luring in many groups of fishes



Gulper Eel
(Eupharyngidae)

Stargazer
(Uranoscopidae)

Capturing Prey: **Luring**

- Independent evolution of luring in many groups of fishes

Nimbochromis livingstonii

Hunting behavior: https://www.youtube.com/watch?v=-XyVW3HXu7Q

Capturing Prey: **Immobilizing Prey**

- Electric shock (electric eels)
- Slashing at your prey, or hitting your prey (thresher sharks, sawfish, billfish)
- Shooting your prey (archerfish)

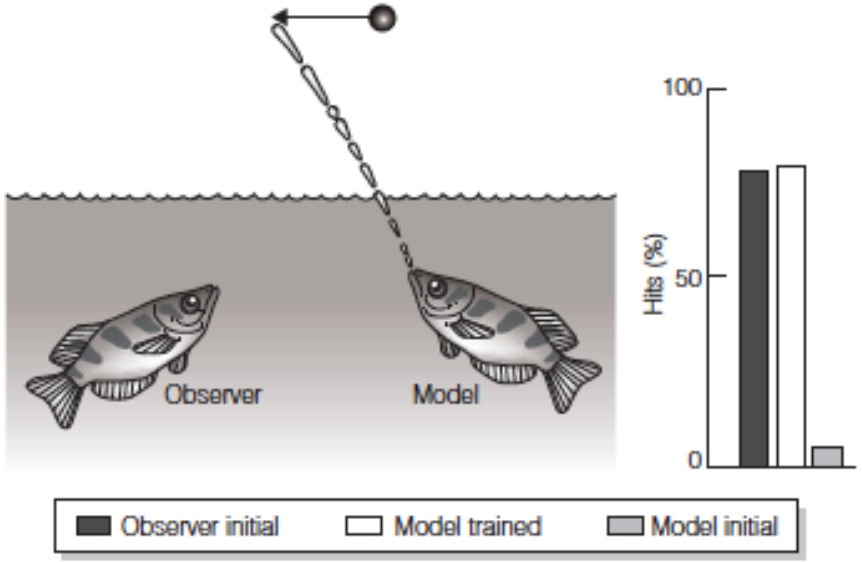


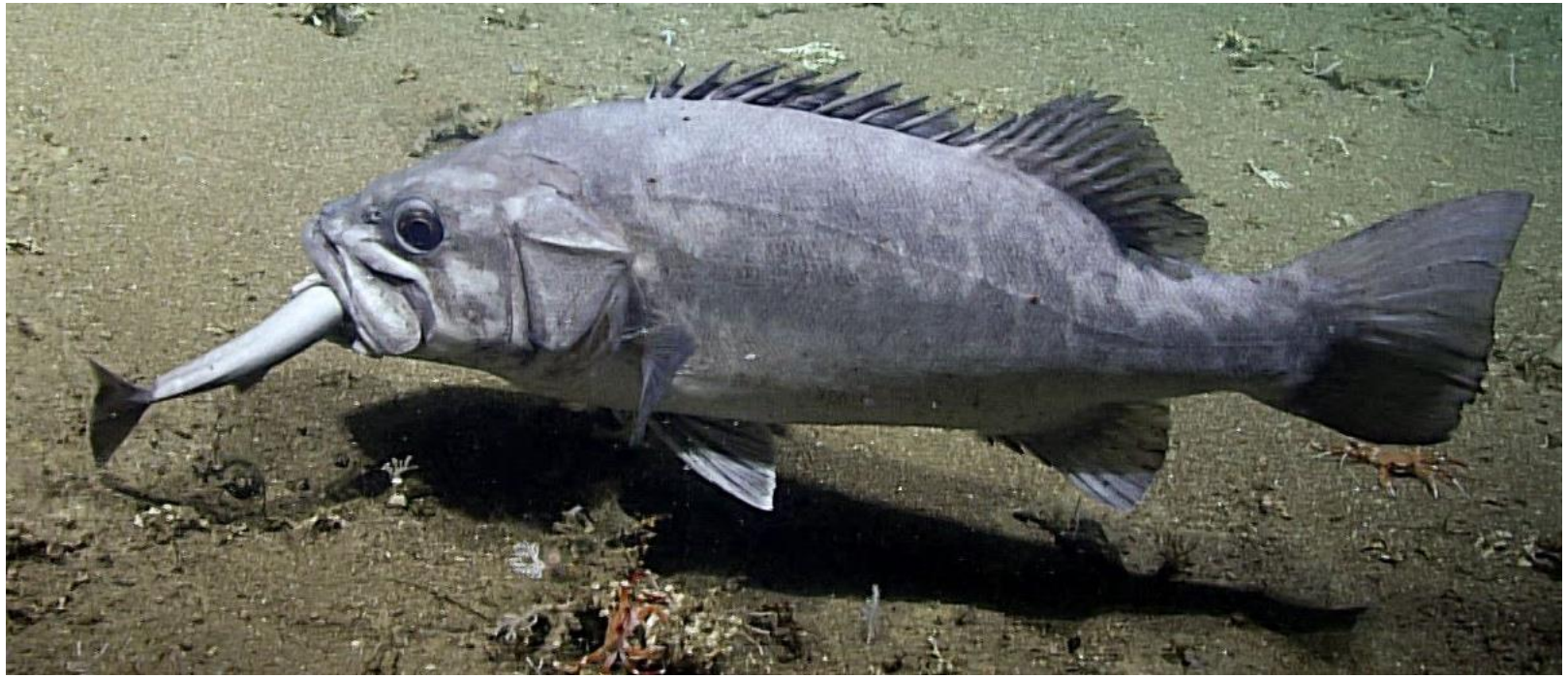
Figure 19.5
Archerfish learn to hit rapidly moving targets by observing other archerfish. Observer archerfish allowed to watch a school member (model) improving its accuracy are almost as accurate on their first shot as the model fish was after more than 1000 shots. Crosshatched bar, initial success of model; open bar, success of model after training; solid bar, average success of observer on its first shot having watched the model. The target was 54 cm above the water and was moving at 5 cm/s. After Schuster et al. (2006).

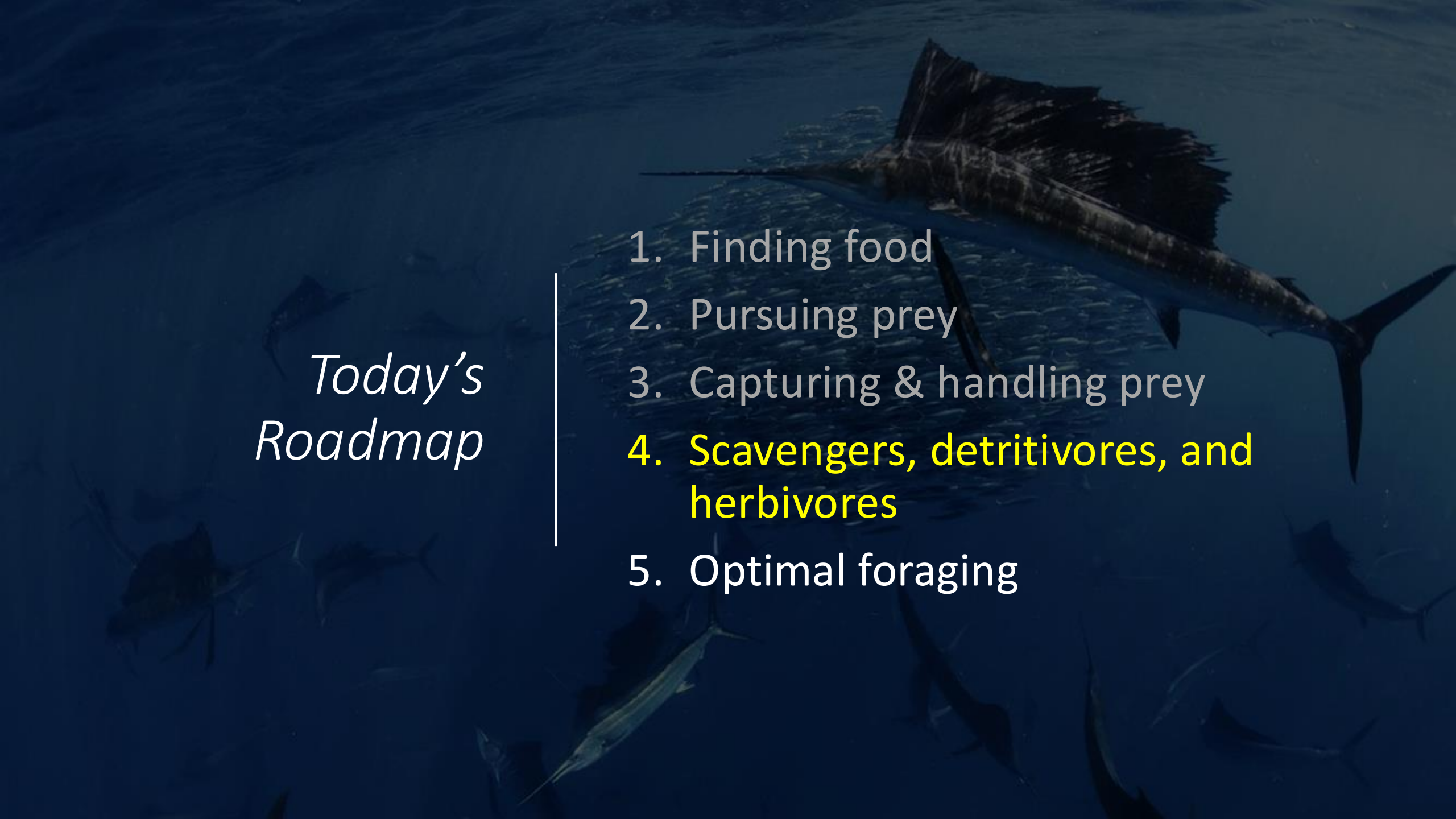
Archerfish
(Toxotidae)

Handling Prey

- Postcapture manipulation required to make some foods ingestible & digestible
- Need to reposition prey fish to be swallowed headfirst!
- Teeth are indicative of prey type (durophagy, piscivory)
- Gill rakers are indicative of prey type (long vs. short)

The famous wreckfish that ate a dogfish live on NOAA ROV footage





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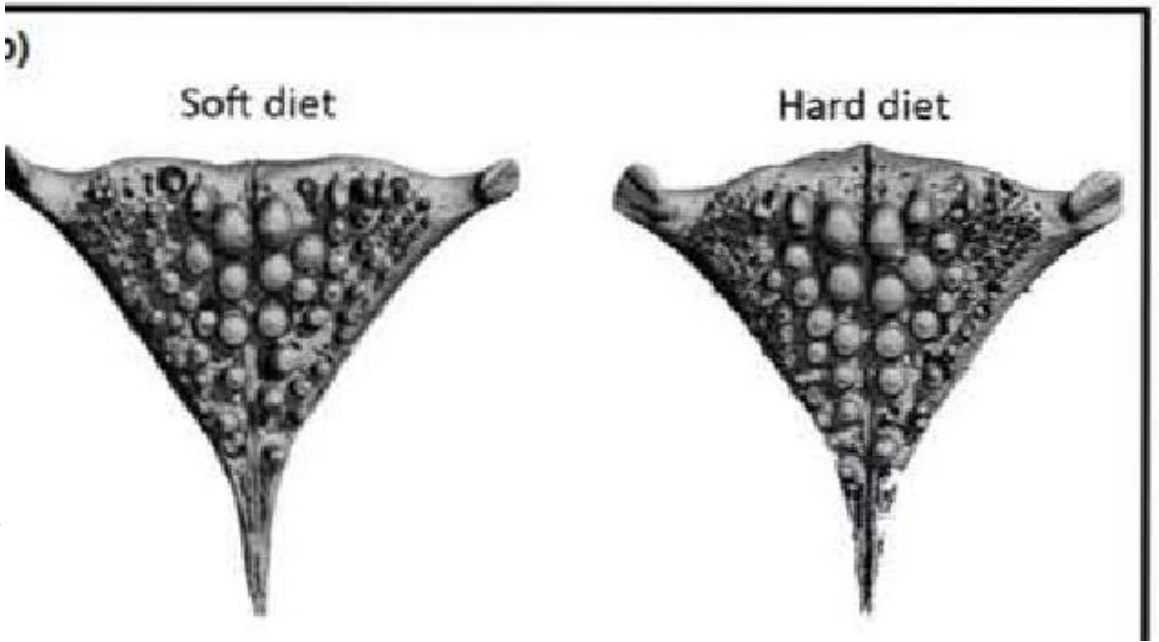
Scavengers & Detritivores

- Almost all fishes will be scavengers if the opportunity arises
- Some fishes (e.g. hagfish) specialize in scavenging
- Detritivores have to **winnow** the edible material from what they eat

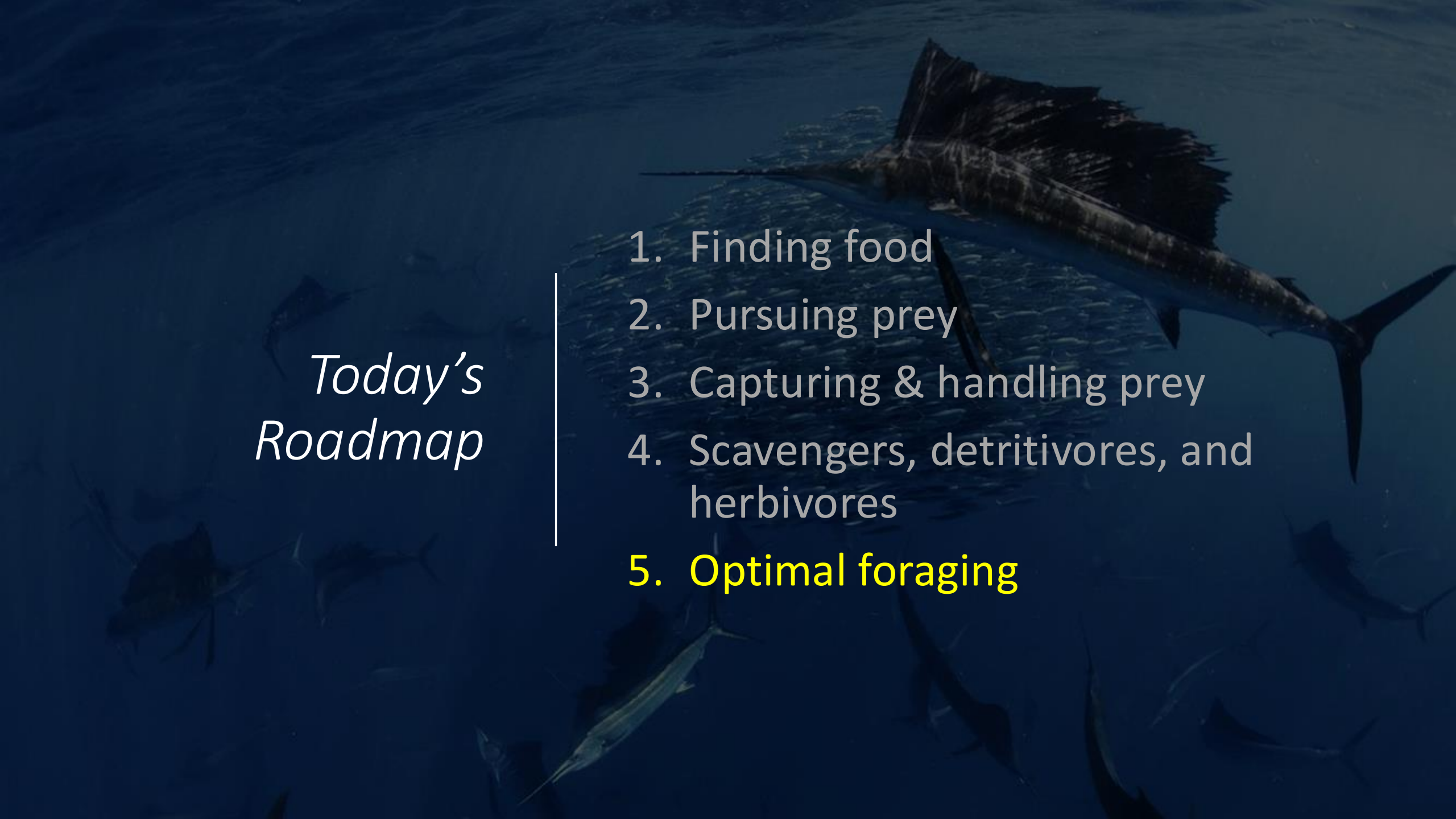
Winnowing in the cichlid
Satanoperca daemon
GIF by Hannah Weller

Herbivory

- Relatively uncommon in fishes
- **Pharyngeal mills** and **gizzards** for breaking down plant matter
- Herbivores **mostly feed during the day** – why?
- Reef herbivores are often **territorial** – why?
- Herbivores have a **long gut** – why?



Gunter & Meyer 2014: Diet induced adaptive plasticity in the lower pharyngeal jaws of (a) *Astatoreochromis alluaudi*. (b) Ingestion of hard shelled snails, or soft, pulverised snails induces development of alternative jaw morphs, character ised by differences in tooth size, jaw size and jaw shape



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Optimal foraging: Cost vs. Benefit

- Fishes are most selective when food is abundant
- Fishes move from one area to another to maximize foraging returns
- Theoretically, natural selection results in maximized **greatest relative return**